

## Features and Benefits

- n Rotary Position Gear Tooth Sensor
- n Short Circuit Protection
- n On-chip 10 bit A/D Converter
- n Self-Adjusting Magnetic Range
- n High Speed Operation
- n No Chopper Delay
- n Zero Speed Detection
- n No Rotary Orientation Concerns

## Applications

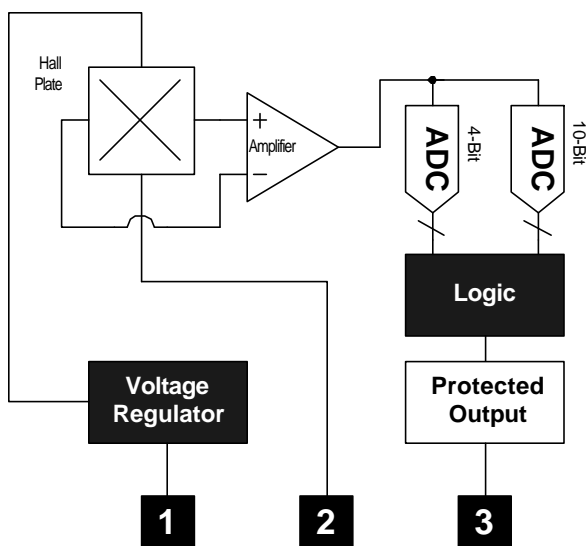
- n Camshaft Sensor
- n Geartooth Sensor
- n Linear Encoder
- n Rotary Encoder
- n Direction Detection\*

\*See applications example

## Ordering Information

| Part No. | Temperature Suffix | Package | Temperature Range         |
|----------|--------------------|---------|---------------------------|
| MLX90217 | L                  | UA      | -40°C to 150°C Automotive |

## Functional Diagram



Pin 1 -  $V_{DD}$  (Supply)  
 Pin 2 -  $V_{SS}$  (Ground)  
 Pin 3 - Output

## Description

The MLX90217 is a self adjusting digital output rotary position gear tooth sensor designed for use in automotive camshaft sensing as well as other speed sensing applications. It is designed to be used with a bias magnet south facing the back (non-marked) side of the IC. The device has an open collector output which is short circuit protected.

The MLX90217 is a sophisticated IC featuring an on-chip 10-bit A/D Converter and logic that acts as a digital sample and hold circuit. A separate 4-bit A/D converter provides a fixed hysteresis. The 90217 does not have a chopper delay. The 90217 uses a single Hall plate which is immune to rotary alignment problems. The bias magnet can be from 50 to 400mT.

As the signal is sampled, the logic recognizes an increasing or decreasing flux density. The output will turn on (BOP) after the flux has reached its peak and decreased by an amount equal to the hysteresis. Similarly the output will turn off (BOP) after the flux has reached its minimum value and increased by an amount equal to the hysteresis.

*Note: Static sensitive device, please observe ESD precautions.*

## MLX90217 Electrical Specifications

DC Operating Parameters  $T_A = -40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ ,  $V_{DD} = 3.5\text{V}$  to  $24\text{V}$  (unless otherwise specified).

| Parameter                     | Symbol      | Test Conditions   | Min | Typ | Max | Units                   |
|-------------------------------|-------------|---|-----|-----|-----|-------------------------|
| Supply Voltage                | $V_{DD}$    | Operating   | 3.5 | -   | 24  | V                       |
| Supply Current                | $I_{DD}$    | $V_{DD} = 12\text{V}$                                     | 1.5 | 3.0 | 4.5 | mA                      |
| Supply Current                | $I_{DD}$    | $V_{DD} = 3.5\text{V}$ to $24\text{V}$                    | 1   | -   | 6   | mA                      |
| Leakage Current               | $I_{LEAK}$  | $V_{OUT} = 3.5\text{V}$ to $24\text{V}$                   | -   | -   | 10  | $\mu\text{A}$           |
| Output Current                | $I_{OUT}$   | Operating   | -   | -   | 25  | mA                      |
| Output Saturation Voltage     | $V_{SAT}$   | $V_{DD} = 12\text{V}$ , $I_{OUT} = 25\text{mA}$           | -   | -   | 600 | mV                      |
| Output Short Circuit Current  | $I_{FAULT}$ | Fault   | 50  | 100 | 150 | mA                      |
| Output Short Circuit Shutdown | $T_{FAULT}$ | Fault   | 100 | -   | 200 | $\mu\text{S}$           |
| Clock Frequency               | $f_{CLK}$   | Operating   | 300 | 500 | 800 | kHz                     |
| Output Rise Time              | $t_r$       | $V_{DD}=12\text{V}$ $R_1 = 880\Omega$ $C_1 = 20\text{pf}$ |     | -   | 400 | nS                      |
| Output Fall Time              | $t_f$       | $V_{DD}=12\text{V}$ $R_1 = 880\Omega$ $C_1 = 20\text{pf}$ |     | -   | 400 | nS                      |
| Bandwidth                     | BW          | Operating   | -   | -   | 15  | kHz                     |
| Thermal Resistance            | $R_{TH}$    | Operating   | -   | -   | 200 | $^{\circ}\text{C/Watt}$ |

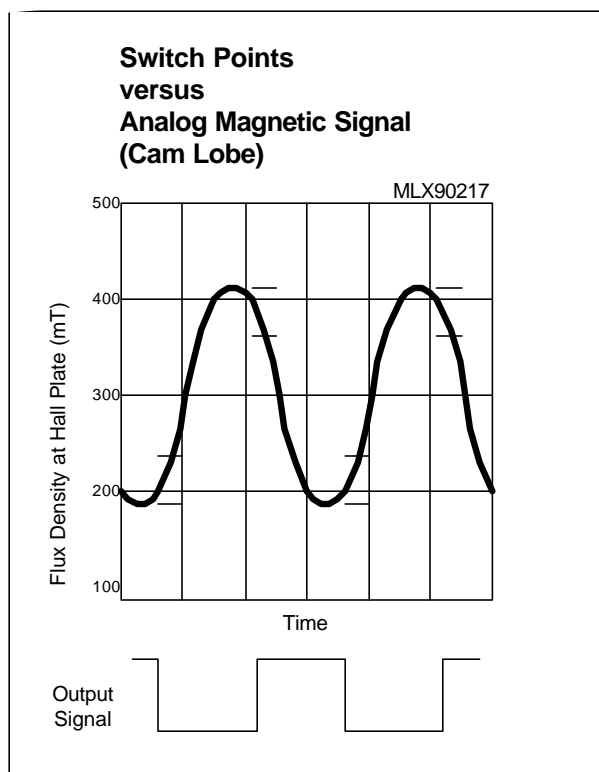
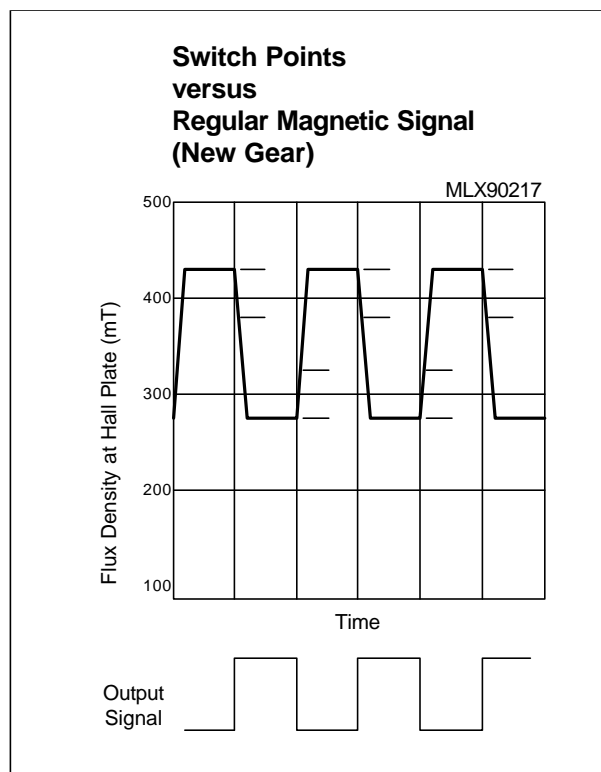
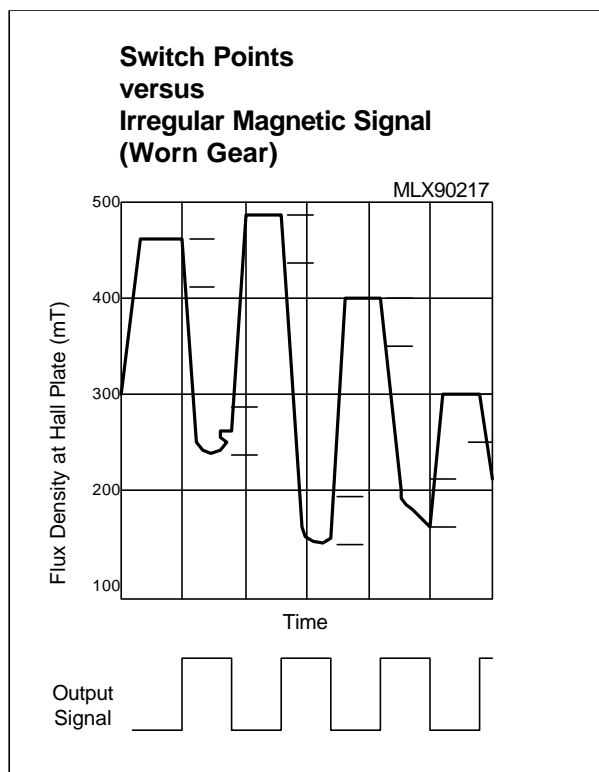
## MLX90217 Magnetic Specifications

DC Operating Parameters  $T_A = -40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ ,  $V_{DD} = 3.5\text{V}$  to  $24\text{V}$  (Unless otherwise specified)

| Parameter       | Symbol     | Test Conditions                        | Min | Typ | Max | Units |
|-----------------|------------|--|-----|-----|-----|-------|
| Back Bias Range | $B_{BIAS}$ | Operating                              | -30 | -   | 400 | mT    |
| Linear Region   |            | $V_{DD} = 12\text{V}$                  | 50  | -   | 500 | mT    |
| Hysteresis      | $B_{hys}$  | $V_{DD} = 3.5\text{V}$ to $24\text{V}$ | 1.8 | 3.5 | 10  | mT    |

Notes: 1mT=10Gauss

## Performance Graphs



## Absolute Maximum Ratings

|                                      |               |
|--------------------------------------|---------------|
| Supply Voltage (Operating), $V_{DD}$ | 30V           |
| Supply Current (Fault), $I_{DD}$     | 50mA          |
| Output Current (Fault), $I_{OUT}$    | 30mA          |
| Output Current (Fault), $I_{fault}$  | 50mA          |
| Output Voltage, $V_{OUT}$            | 30V           |
| Power Dissipation, $P_D$             | 100mW         |
| Operating Temperature Range, $T_A$   | 40°C to 150°C |
| Storage Temperature Range, $T_S$     | 65°C to 150°C |
| Maximum Junction Temp, $T_J$         | 175°C         |
| ESD Sensitivity                      | +/- 7KV       |

## *Application Notes*

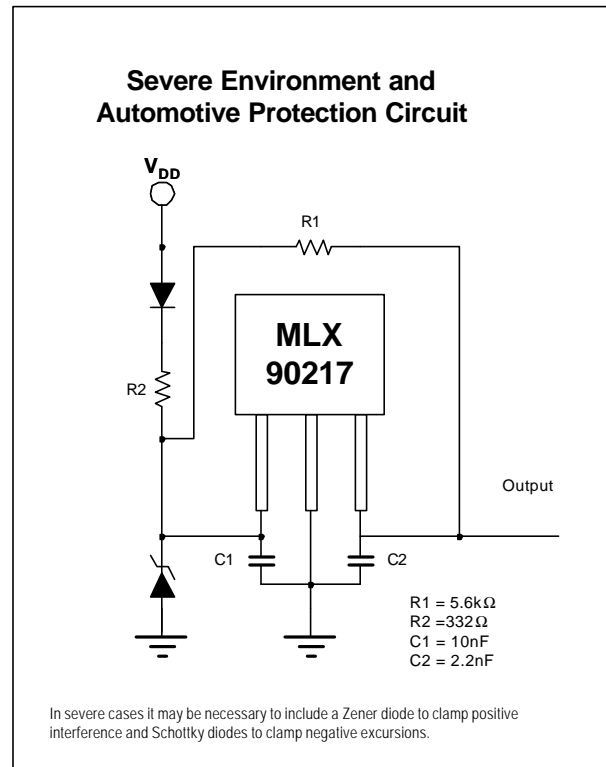
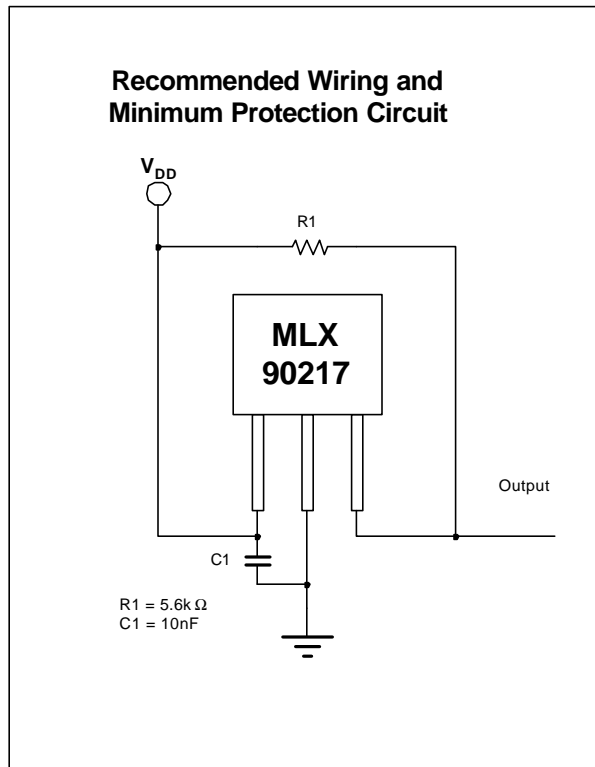
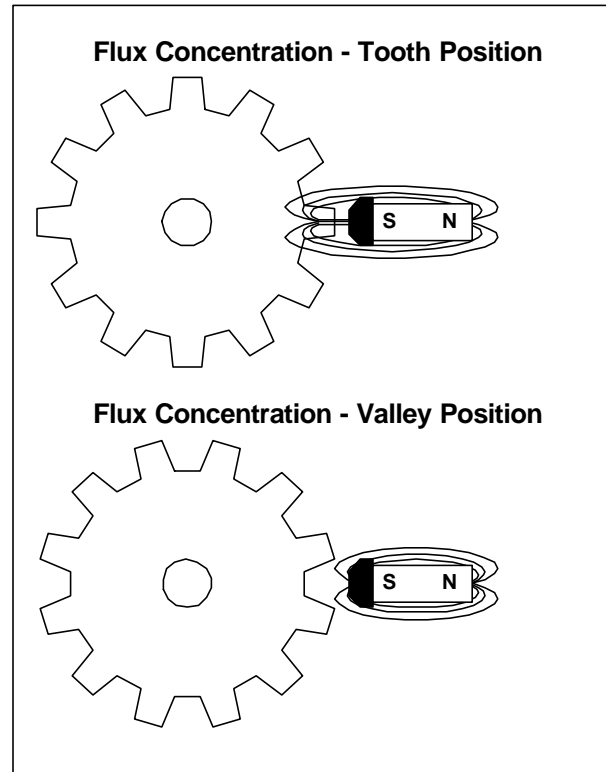
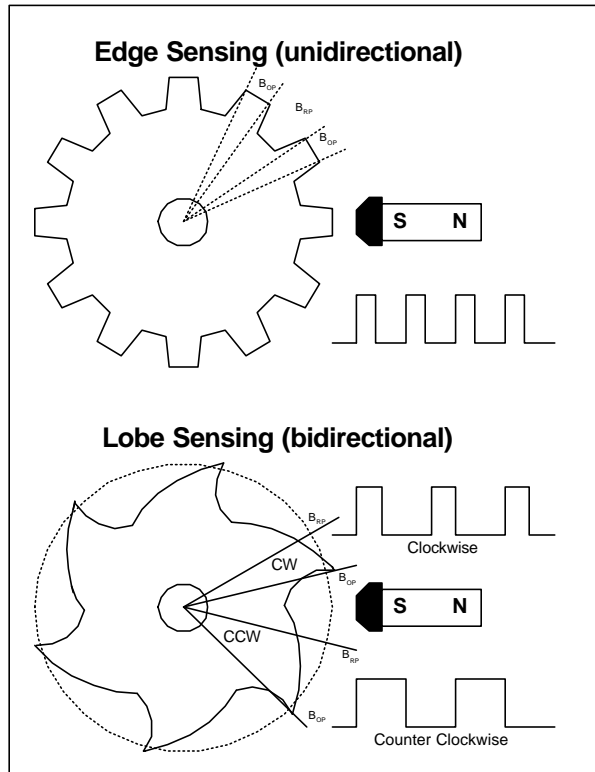
Maximum dynamic range is 500 mT. The hysteresis is fixed at 5.0 mT. Best angular accuracy will be obtained when the magnetic circuit provides peak magnetic flux at the chip near the high end of the linear range of 500 mT. EMC protection using external components are recommended. Two possibilities are shown on the following page. Normally the South pole faces the unbranded side of the device. A North pole will enable a test sequence used in factory testing.

## *Unique Features*

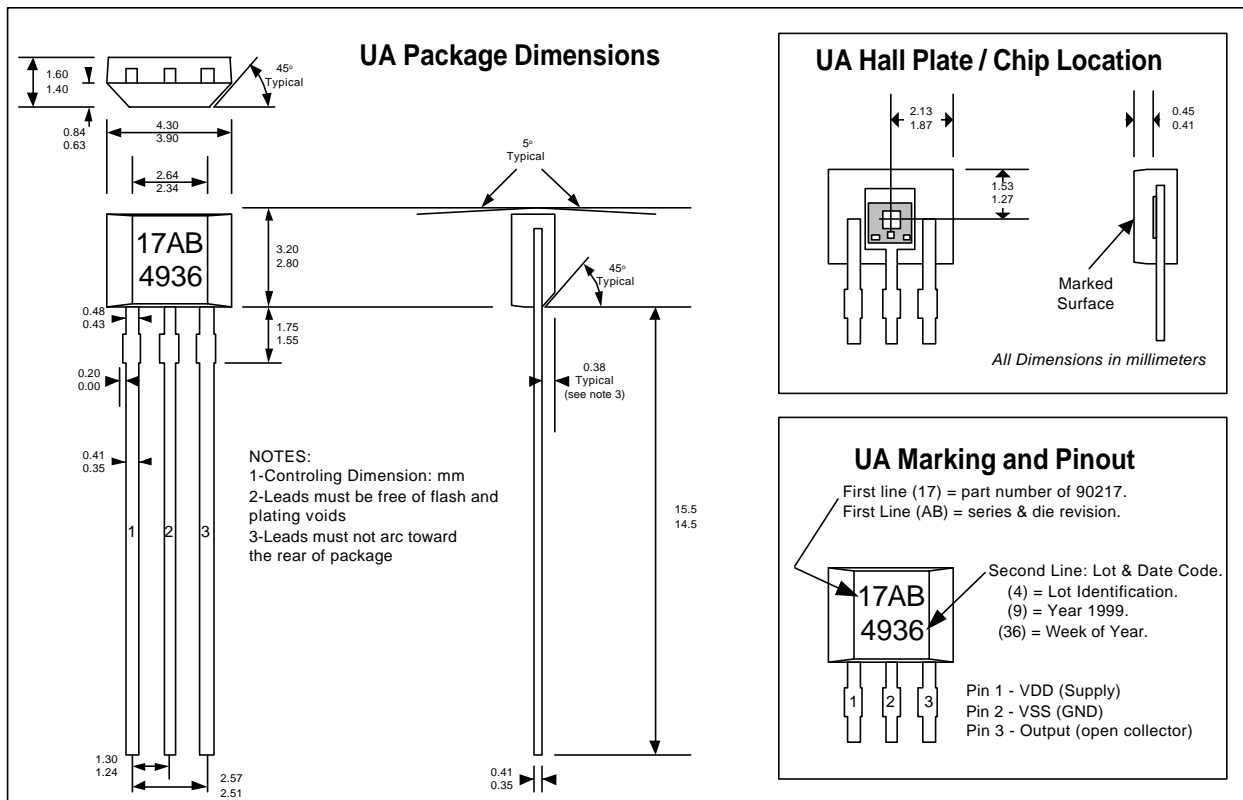
The output is reset to the high state at power on (output driver is off) whatever the field is. The output only changes after the first min is detected. The reset state holds no information about the field. If the supply of the chip is raised slowly, the reset state is not stable. This has been observed at 0 field but it should be the same with small and large fields.

Gear tooth sensors often need to be adjusted after the module is assembled to align the magnet with differential Hall plates or orient with teeth. However the MLX90217 is “self adjusting” over a wide range of back bias flux eliminating the need for any trimming in the application. The magnet may be glued to the back surface (non branded side) of the IC using a cyanoacrylate adhesive or suitable epoxy.

## Applications Examples



## Physical Characteristics



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